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### HANDBOOK FOR COMMERCIAL WEIGHING AND MEASURING DEVICES

In furthering its policy of cooperation with the States in matters of weights and measures administration and the promotion of uniform technical requirements for commercial weighing and measuring equipment, the Bureau works in close harmony with the National Conference on Weights and Measures. The codes adopted by the Conference do not, by reason of such adoption, become effective in particular jurisdictions; to give these codes legal force and effect they must be promulgated by competent legal authority in and for the several weights and measures jurisdictions. Codes adopted by the National Conference are, however, recommended by the Bureau for State promulgation.

In 1929 the Bureau published a compilation of the various codes of specifications and tolerances as adopted by the National Conference. This material having become entirely out of date, a revision of the handbook has been

prepared, designated as Handbook H22 of the National Bureau of Standards. This revision includes the recommendations of the Twenty-Seventh National Conference on Weights and Measures, held in 1937.

Handbook H22 is of current interest and value not only to weights and measures officials, but also to manufacturers and purchasers of weighing and measuring devices, and to the buying and selling public in general. It is substantially bound in brown buckram in a convenient size, 5 by 7½ inches, and comprises codes for: Linear measures, fabric-measuring devices, taximeters, and odometers; Liquid capacity measures, glass graduates, milk bottles, lubricating-oil bottles, liquid-measuring devices, grease-measuring devices, and vehicle tanks; dry capacity measures, berry boxes and baskets; scales (this series of codes was extensively revised and rearranged in 1936 and 1937); and weights.

Copies of Handbook H22 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 50 cents each.

<sup>1</sup> Published with approval of the Director of the Budget.

### FIBER BOXES FOR CANNED FRUITS AND VEGETABLES

Simplified Practice Recommendation R146-38, the first revision of the recommendation entitled "Corrugated and Solid Fiber Boxes for Canned Fruits and Vegetables", became effective on March 1, 1938.

The original recommendation was approved by a general conference of manufacturers of fiberboard containers, canners, grocers, and others interested, as of January 1, 1933. It established a simplified schedule of 41 sizes of corrugated and solid fiber boxes, based on arrangement and number of cans per box for the 27 stock sizes of fruit and vegetable cans adopted by a general conference of the canning industry in 1931. Prior to the development of this project, boxes of the type specified were being made in more than 150 sizes.

The current revision, which reduces the 41 sizes of boxes to 26, was proposed by the industry's standing committee in cooperation with the National Container Association. It is based on unit of pack and arrangement of cans in box for the 21 stock sizes of cans now comprising the simplified list. In addition to a list of the inside dimensions for the 26 sizes of containers, the recommendation gives sizes of cans (can makers' description), trade names of cans, number of cans per box, and arrangement of cans.

The revised printed issue will include a brief history of the development of the project, and will list the members of the industry's standing committee and the organizations and firms that have accepted the recommendation.

Until printed pamphlets are available, free mimeographed copies of the revision may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

### SERVICEABILITY OF SHOES CONSTRUCTED IN DIFFERENT WAYS

The increasing interest in standards for footwear is shown by the number of requests which the Bureau receives from organizations and individuals for information about the methods of shoe construction in common use. The comparative merits of shoes of different constructions, from the point of view of service, and the feasibility of marking shoes as to the type of construction for the benefit of the consumer, are questions raised frequently. Circular C419 discusses these questions.

An analysis of the figures for annual shoe production is included, from which an idea may be obtained concerning

the importance of each main class of construction in relation to the total number of shoes manufactured. This gives a general picture of what the consumer is buying.

The terms generally used to denote types of construction are: (1) Welt; (2) McKay; (3) Littleway; (4) Turn; (5) Stitchdown; (6) Nailed; (7) Cemented; and (8) Moccasin. It is shown, however, that these names by no means convey the necessary information regarding the various types of construction used. More than 40 individual constructions are described and classified under the 8 headings listed above. Individual constructions in a main group vary among themselves to such a degree that a group name is not indicative of the true construction used. The value to the consumer of marking shoes is discussed, and it is pointed out that such marking is of doubtful value because of the many grades of shoes which can be made by the same method of construction.

Performance tests of ladies' leather shoes on a laboratory endurance machine have shown that shoes of 4 different constructions, made of the same quality of materials and the same standards of workmanship, will stand up equally well on the machine while making 1,000,000 steps under normal conditions of load and flexure.

The subject matter will doubtless be of interest to consumers, to manufacturers, and retailers of shoes, and to students of home economics. Copies of this circular are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

### APPLICATION OF THERMODYNAMICS TO THE CHEMISTRY OF RUBBER

Measurements of the basic thermodynamic constants of rubber which have been made at the Bureau during the past few years are summarized and correlated in a paper on "Application of Thermodynamics to the Chemistry of Rubber." This paper will be presented by Dr. Norman Bekkedahl at the World Conference on Rubber Technology, which is to be held in London in May 1938.

The introductory part of this paper deals with the general methods whereby the change in free energy of a chemical reaction may be employed in the prediction of the direction and the driving force of that reaction under various conditions. This thermodynamic function is applied in the paper

to the reaction isoprene  $\rightleftharpoons$  rubber. The change in free energy (often called the thermodynamic potential) of the above reaction is obtained as the difference between the free energies of formation of the rubber and of the isoprene from their elements, carbon and hydrogen. These free energies of formation are calculated from measurements of the entropies and heats of combustion of the rubber and the isoprene.

The entropy and the heat of combustion of rubber have been reported in J. Research NBS 15, 503 (1935) RP844 and 13, 357 (1934) RP713, respectively; similar data on isoprene are given in J. Research NBS 19, 551 (1937) RP1044, and 20 (May 1938), RP1093, respectively. A general discussion of the relation between the different amorphous and crystalline forms of rubber have been given in J. Research NBS 13, 411 (1934) RP717.

At 298.2 K (25° C) the difference in free energies of the isoprene and the rubber is such as to favor strongly the formation of rubber from isoprene. With increasing temperature, however, this difference becomes progressively less, and at about 800° K (527° C) at atmospheric pressure the balance shifts, and above this temperature the reaction proceeds in the direction favoring the formation of isoprene from rubber.

#### HEAT OF COMBUSTION OF ISOPRENE

A paper by Rolph S. Jessup (RP1093) in the Journal of Research for May, reports part of an investigation undertaken to provide data for a study of the thermodynamics of reactions involving rubber and related substances. In previous papers, data have been reported on the heat of combustion of rubber, on the entropy and free energy of formation of rubber, and on the entropy of isoprene. An accurate value for the heat of combustion of isoprene was required for use with the entropy of formation in calculating the free energy of formation of this substance. The importance of data on the properties of isoprene may be seen from the following facts: Isoprene is closely related to rubber in its chemical composition, having the same empirical formula,  $C_5H_8$ ; it is one of the two principal products of the destructive distillation of rubber; it can be polymerized to form a product similar in its properties to natural rubber; and it is thought to be the substance from which rubber is formed in plants, and to play

an important role in the growth of plant cells.

The measurements of heat of combustion of the liquid isoprene were made by means of a bomb calorimeter which was calibrated with NBS standard sample benzoic acid. To prevent evaporation of the liquid in the bomb, the samples were inclosed in thin-walled glass bulbs which were flattened on opposite sides and filled completely with the liquid. The yielding of the flexible flat side of the bulbs under pressure of the oxygen in the bomb was sufficient to transfer the support of the pressure to the inclosed liquid, and the bulbs did not break until the electric fuse used to ignite the samples was fired. No combustible material other than the iron wire of the electric fuse was required to ignite the samples. The amount of isoprene burned in each experiment was determined from the mass of  $CO_2$  formed in combustion, thus eliminating errors from inert impurities in the sample and reducing those arising from uncertainty in the atomic weight of carbon.

Seven experiments to determine the heat of combustion of liquid isoprene at 25° C, under a constant pressure of 1 atmosphere gave the value  $3156.9 \pm 1.6$  international kilojoules per mole, when the products of combustion are liquid water and gaseous  $CO_2$ . This is higher by about 2.5 percent than the value previously obtained for the heat of combustion of rubber per  $C_5H_8$  unit. The corresponding value for the heat of combustion of gaseous isoprene is calculated to be  $3182.8 \pm 1.7$  international joules per mole.

#### BOILING POINTS OF BENZENE, ETHYLENE CHLORIDE, *n*-HEPTANE, AND 2,2,4-TRIMETHYL-PENTANE

By the comparative ebulliometric method, using water as the reference standard and ebulliometers of the "wito-lawski" type, data were obtained from which we developed equations expressing the relation between temperature and vapor pressure from 660 to 860 mm for benzene, ethylene chloride, *n*-heptane, and for 2,2,4-trimethylpentane (isooctane).

In RP1097, by Edgar Reynolds Smith and Harry Matheson, which will be published in the May number of the Journal of Research, these equations are given, and the use of these substances as reference standards for boiling-point measurements is discussed. Equations for the relative volatilities of the two pairs, benzene-ethylene chlo-

ride and  $\alpha$ -heptane-2,2,4-trimethylpentane are presented. The data show that Duhring's rule and the corresponding reciprocal temperature relationship hold accurately over a limited range of pressures, even for substances of different types.

#### ANALYSIS OF PHOSPHATE ROCK

In analyzing the Bureau's Samples of Phosphate Rock, 56a and 120, a number of improvements in old methods were made, and some new ones were developed. Most of the methods that were used when the Bureau's first standard sample of phosphate rock was issued in 1924 are still in use, but many of them have been modified to such an extent that publication of the new and revised methods seems desirable. These methods are described in RP1095 by James I. Hoffman and G. E. F. Lundell, which will be published in the May number of the *Journal of Research*. A summary of the results obtained by nine cooperating analysis is given. The usual chemical analysis is supplemented by a qualitative spectrochemical examination, and one constituent, boric oxide, has been quantitatively determined by chemical and spectrochemical methods.

#### SHRINKAGE OF PLASTIC CALKING COMPOUNDS

Plastic calking compounds used on masonry buildings exhibit two types of shrinkage: That due to loss of volatile matter, and that due to contact with a porous masonry material. In the latter case a further shrinkage usually occurs because of absorption of oil from the plastic into the masonry.

In recent work at the Bureau, shrinkage from loss of volatile matter was determined by placing the sample of plastic in a brass ring supported on a glass plate with the upper surface of the sample exposed to the air. The original volume of the calking, glass plate, and ring was determined by weighing the specimen first in air and then in water. These volume determinations were repeated at intervals and the changes were assumed to represent the shrinkage of the plastic. To determine the shrinkage from absorption of oil by a porous material in contact with the plastic, a brass ring was placed on a small slab of limestone and filled half-full of the sample. Changes in volume of the plastic were determined by weighing the specimen dry and then with the ring filled with water. By grinding the upper edge of

the ring and covering with a ground glass plate fairly accurate changes in volume could be obtained. The latter test gave the combined shrinkage from loss of volatile matter and the absorption of oil, and hence in order to determine the oil-loss shrinkage it was necessary to subtract the amount of shrinkage from volatile matter as determined with the sample on glass.

Shrinkage determinations on 70 samples of proprietary calking compounds indicate that the volume changes continue over a period of at least 30 days and for some samples a greater length of time. Shrinkages from loss of volatile matter as high as 25 percent were obtained at the end of 30 days, while the average for all of the samples was 7.5 percent. The combined shrinkage from loss of volatile matter and loss of oil gave an average of 11.3 percent with a maximum of 34 percent. The plastics showing high shrinkage are apt to crack away from the material they are supposed to seal together, and hence give poor service.

#### MEASURING VIBRATION IN FRESH CONCRETE

While studying the placing of fresh concrete by vibration, an apparatus was developed for measuring the amplitudes, frequencies, and accelerations of the vibrations within the concrete. Measurement of these vibration characteristics should prove helpful in studying the efficiency of different sizes and types of vibrators, and should also furnish helpful information on many other factors influencing the placement and compaction of concrete. Accordingly, an electromagnet pick-up unit, an electrical differentiating circuit, an electrical integrating circuit, and an amplifying unit have been designed and built at the Bureau for use in conjunction with a cathode-ray oscillograph for making such measurements. These are described in a paper by George L. Pigman, F. B. Hornibrook, and J. S. Rogers (RP1101) in the May number of the *Journal of Research*.

The pick-up unit, inclosed in a rigid, water-tight case, consists essentially of an electromagnet suspended from the case by two springs giving a long natural period, and a pick-up coil, rigidly attached to the case, which moves in the airgap of the magnet. The case is attached by means of a semiflexible joint to a metal tube several feet long through which extend the lead wires. By this arrangement the unit can be used as a probe to pick up the vibration at different positions in a mass of concrete.

The unit is designed to respond only to linear motion in a horizontal plane.

The relative motion of the pick-up case and magnet generates a voltage in the pick-up coil which is proportional to the instantaneous velocity of the case. This voltage is passed through one of three circuits, an attenuating circuit, an integrating circuit, or a differentiating circuit, and then through a three-stage amplifier to a cathode-ray oscilloscope. According to the circuit chosen, the signal appearing on the oscilloscope screen is proportional respectively to the instantaneous particle velocity, displacement, or acceleration.

A volume control incorporated in the amplifier allows various ranges to be chosen so that amplitudes from 0.00035 to 0.045 inch, velocities from 0.01 to 2.5 feet per second, and accelerations from about  $\frac{1}{16}$  to 40 times gravity can be measured (for conditions giving a steady signal), with maximum error of 3 percent over a frequency range of 20 to 300 cycles per second.

The amplitude scale was calibrated by comparing oscilloscope readings with the corresponding optically-measured amplitude of the pick-up unit placed on a vibrating plate. The velocity and acceleration scales were calibrated by replacing the pick-up unit with a beat-frequency oscillator delivering a sine wave of known voltage and frequency.

A brief study to determine the performance of the apparatus while measuring vibrations in concrete indicated that, except for approximately the first 4 inches from the vibrator, measurements of sufficient accuracy could be made.

A study of the corresponding displacement, velocity, and acceleration wave forms obtained of vibration in concrete produced by several different vibrators showed that although the displacement wave form might be superficially sinusoidal, the corresponding acceleration wave form is apt to show considerable irregularity because of harmonics.

#### COMPUTATION OF HEAT TREATMENTS FOR WHITEWARE BODIES

A formula for calculating various schedules for heating feldspathic white-ware bodies to a specified degree of vitrification is given in a paper by W. W. Meyer, which was published in the March 1938 issue of the *Journal of the American Ceramic Society*. (The degree of vitrification was evidenced by the physical properties, especially the

bulk specific gravity of the heat-treated specimens.)

A chart is also given by means of which many heat-treatment problems can be solved without using mathematical formulas. There are four variables involved in the chart: (1) Total reaction of body constituents (sometimes referred to as "heat work", above 1,160° C, designated by  $\Delta\Sigma$ ; (2) constant rate of temperature rise above 1,100° C; (3) maximum temperature of heat treatment or soaking temperature; and (4) soaking time. With any three of these variables given, the fourth can be found. By using tabulated data presented, in conjunction with the chart, heat treatments which will cause vitrification of feldspathic white-ware bodies of known RO contents can be ascertained.

Data on the physical properties of variously heat-treated bodies are given to substantiate the validity of chart and formula.

#### COOLING RATE OF IRON-CARBON ALLOYS AND CARBON STEELS

The depth to which steel will harden is influenced by its composition and grain size at the time of quenching. In the Bureau's Division of Metallurgy, Thomas G. Digges has been making some experiments to determine the role that carbon plays in controlling the hardenability of high-purity iron-carbon alloys and plain carbon steels. To accomplish this a series of high-purity iron-carbon alloys and two series of plain carbon steels were prepared, in which the chemical composition of each series was kept constant except for the amounts of carbon present. The preparation of these alloys and steels and their hardening properties for various conditions are discussed in RP1092 in the May *Journal of Research*.

Analyses made on specimens of the iron-carbon alloys showed that they contained negligible amounts of impurities, the value for all those determined being only about 0.03 percent by weight.

The critical cooling rate, that is, the slowest cooling rate for which the steel will be fully hardened, was determined under controlled conditions for both the high-purity iron-carbon alloys and carbon steels. The critical cooling rate was then used as an index of the hardenability of these alloys and steels.

It has been usually believed that plain carbon steels containing about 0.80 to 0.90 percent of carbon have slower critical cooling rates, i. e., are deeper hard-

ening, than similar carbon steels containing either lower or higher amounts of carbon.

In the present experiments, it was shown that the carbon steel, containing about 0.80 percent of carbon, was deeper hardened than the higher carbon steels only for the conditions where the hardenability of the steels was influenced by factors such as variations in grain size, or when all carbon was not in solution at the time of quenching.

In the experiments where average grain size was constant and all carbon was in solution at the time of quenching, it was shown that the critical cooling rate decreased continuously as the carbon content increased for the iron-carbon alloys and also for the steels. In other words, the iron-carbon alloy containing the highest amount of carbon (1.21 percent) had the greatest depth of hardening of this entire series of alloys, and likewise the carbon steel containing the highest amount of carbon had the greatest depth of hardening of that entire series. However, to utilize the full hardening power of the alloys and steels, it was necessary to heat them to temperatures sufficiently high to insure the complete solution of the carbon.

Comparison of the hardenability of the high-purity iron-carbon alloys and plain carbon steels shows that the former were comparatively shallow hardened. This difference in hardenability was due to the higher manganese content of the steels.

An important feature brought out in these experiments, therefore, is the influence of the dissolved carbon content of the alloys and steels at the time of quenching on their hardenability.

#### ELECTROMOTIVE FORCE OF STANDARD CELLS CONTAINING DEUTERIUM OXIDE

Saturated Weston cells are used by the National laboratories as standards for the volt, and much effort has been devoted to improving their reproducibility and constancy. In the Journal of Research for May (RP1094) Langhorne H. Brickwedde and George W. Vinal describe experiments to learn the effect of substituting deuterium oxide, commonly known as "heavy water," for part of the water employed in constructing the cells. The results show that the "heavy-water cells" are fully as good, and perhaps in some respects better than the ordinary cells, the effect of the deuterium oxide being to decrease slightly the electromotive force of the cells. This decrease is not a disadvan-

tage because the first requisites are reproducibility and constancy of electromotive force, and the results to date indicate average deviations of single observations from the mean of the respective groups amounting to less than one-millionth part of a volt. Plans are being made, therefore, to extend the work to higher concentrations of deuterium oxide.

#### MAXIMUM USABLE FREQUENCIES FOR RADIO SKY-WAVE TRANSMISSION, 1933-37

The highest radio frequency that can be used for sky-wave transmission over a given distance, depends on the condition of the ionosphere and varies diurnally, seasonally, and over a long period associated with the 11-year sunspot cycle. The maximum usable frequencies are calculated from the regular, systematic ionosphere measurements made at the Bureau.

In the Journal of Research for May (RP1096), T. R. Gilliland, S. S. Kirby, N. Smith, and S. E. Reymer, present graphs to indicate the maximum usable frequencies for sky-wave transmission from June 1933 to December 1937. The graphs are given for March, June, and December to show equinoctial, summer, and winter conditions for each year. The period covered is about one-half of an 11-year sunspot cycle, from a sunspot minimum to a maximum, during which time the maximum usable frequencies were approximately doubled.

Since the condition of the ionosphere varies with local time and geographic latitude, it may not be uniform over the transmission path, especially if the path is a long one. Therefore, for single-hop transmission, the time of day to be used in applying the maximum usable frequency graphs is the local time at either the transmitting or receiving station. Single-hop transmission may take place over the distances indicated in the graphs. For longer distances multi-hop transmission must be used, and the local times at all points of ionosphere reflection must be considered. In this case the one giving the lowest value of the maximum usable frequency is the one which determines the maximum usable frequency for the long distance.

For a small percentage of the time, at irregular intervals the sporadic *E* layer provides transmission at frequencies higher than those indicated on the graphs. These effects have not been included on the graphs.

A poor quality fluttering transmission caused by scattered reflections, is often

found at frequencies above the maximum usable frequencies for *E*- and *F*-layer transmission.

The graphs given here may be used to estimate maximum usable frequencies during the descending half of the sunspot cycle which is expected to occur from 1938 to 1944. Current data are given by the Bureau in its weekly ionosphere bulletins broadcast from WWV each Wednesday, and in reports on the "Characteristics of the Ionosphere at Washington, D. C." published each month in the Proceedings of the Institute of Radio Engineers.

### VERTICAL-INCIDENCE IONOSPHERE MEASUREMENTS AND OBLIQUE-INCIDENCE RADIO TRANSMISSION

The maximum usable frequency for radio sky-wave transmission between two given points is the highest frequency which will be reflected from the ionosphere on going from one point to the other. In order to derive this frequency from vertical incidence ionosphere measurements and to find out how strong the signal will be at the receiver, it is necessary to consider many factors, including transmission distance, influence of the earth's magnetic field on the wave, influence of the curvature of the earth on the conditions for reflection from the ionosphere, shape of the frequency-virtual-height curve measured at vertical incidence, and the effect of layers in the ionosphere below the level of reflection. In a previous paper, Newbern Smith has outlined a graphic method for considering the shape of the frequency-virtual-height curve. In the May Journal of Research (RP1100) he takes up the modifications necessitated in this method because of some of these factors.

The earth's curvature causes the maximum usable frequency to be higher than that which would be calculated on the simple plane-earth theory. This effect may be taken into account by modifying the vertical incidence measurements before applying the transmission curves described in the previous paper. This modification consists of a lowering of the experimentally observed virtual heights and an increase in the vertical-incidence critical frequency, the difference being greater for the greater distances.

The chief effect of the earth's magnetic field is to cause a radio wave to split up into two components, which are reflected from different levels in the

ionosphere. This effect is taken care of by plotting two transmission curves for each transmission distance and frequency, one for the *o*- and one for the *x*-component. In general, the *o*-component is reflected at a higher, and the *x*-component at a lower level than is the case in the absence of a magnetic field.

From a knowledge of the ray paths, given by the level of reflection and transmission distance, it is possible to deduce what happens to the wave in the lower ionosphere. A method is described whereby the ray path can be followed, on the transmission curve, for a given reflection point, and whereby the absorption of the wave in, or its reflection from lower ionosphere layers may be determined.

An alinement chart is appended to facilitate the rapid calculation of these transmission curves. Angles of departure of the waves from the horizontal at the transmitter may also be obtained from this chart, and the significance of this angle is discussed briefly. The use of average factors for determining maximum usable frequencies is also considered.

### NEW AND REVISED PUBLICATIONS ISSUED DURING APRIL 1938

#### Journal of Research<sup>2</sup>

Journal of Research of the National Bureau of Standards, volume 20, number 4, April 1938 (RP1085 to RP1091, inclusive). Price, 25 cents. Annual subscription 12 issues, \$2.50. Journal of Research of the National Bureau of Standards, volume 18 (RP957 to RP1005, inclusive), bound in blue buckram, \$3 (\$3.50, foreign).

#### Research Papers<sup>2</sup>

[Reprint from January 1938 Journal of Research]

RP1065. Strength, water absorption, and resistance to freezing and thawing of sand-lime brick. John W. McBurney and Allan R. Eberle. Price, 5 cents.

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$2.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and \$3.25, respectively.

Circulars<sup>2</sup>

C419. Shoe constructions. Roy C. Bowker. Price, 10 cents.

Handbooks<sup>3</sup>

H22. Specifications, tolerances, and regulations for commercial weighing and measuring devices. Price, 50 cents.

Technical News Bulletin<sup>2</sup>

Technical News Bulletin 252, April 1938. Price, 5 cents. Obtainable by subscription.

## MIMEOGRAPHED MATERIAL

## Letter Circulars

Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.

- LC502-J. Heat-transfer measurements in connection with thermal insulation of low-cost housing.
- LC502-K. Ventilation problems (including air infiltration of windows and doors) as related to low-cost housing.
- LC502-L. Heating equipment as related to low-cost housing.
- LC515. Selenium cells; photocells; thermopiles. (Supersedes LC199.)
- LC518. The corrosivity of soils. (Supersedes LC433.)
- LC519. Cathodic protection of pipe lines.

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS<sup>3</sup>

Trends in aviation lighting. F. C. Breckenridge. Trans. Illuminating

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$2.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and \$3.25, respectively.

Eng. Soc. (29 West Thirty-ninth St., New York, N. Y.) 33, 262 (March 1938).

The measurement of flame speeds. Ernest F. Flock and Charles F. Marvin, Jr. Chemical Reviews (Williams-Wilkins Co., Baltimore, Md.) 21, 367 (December 1937).

Report on color names for chemical monographs. Deane B. Judd and Kenneth L. Kelly. Proc. Mid-Year Meeting, Am. Pharmaceutical Mfrs. Assn. (Washington, D. C.) 160 (1938).

The energy of isomerization of normal pentane into tetramethylmethane. Frederick D. Rossini and John W. Knowlton. J. Chem. Phys. (175 Fifth Ave., New York, N. Y.) 6, 168 (1938).

Testing packaging materials for permeability to moisture. F. T. Carson. Food Industries (330 West Forty-second St., New York, N. Y.) 10, No. 3, 130 (March 1938).

A note on rapid photomicrography. W. H. Mutchler and H. O. Willier. Trans. Am. Soc. Metals (7016 Euclid Ave., Cleveland, Ohio) 26, 270 (March 1938).

Discussion of paper on the rate of austenitic transformation in cast iron, by Murphy, Wood, and Girardi. A. I. Krynetsky. Trans. Am. Soc. Metals 26, 188 (March 1938).

Discussion of paper on some factors influencing austenitic grain size in high-purity steels, by Derge, Kommel, and Mehl. T. G. Digges. Trans. Am. Soc. Metals 26, 167 (March 1938).

A rose by any other name. R. F. Geller. Ceramic Age (170 Roseville Ave., Newark, N. J.) 13, No. 2, 35 (February 1938).

The structure of the glassy phase of portland cement clinker. L. T. Brownmiller. Am. J. Science (New Haven, Conn.) 35, 241 (1938).

Basic principles of healthful housing. Preliminary report of Committee on the Hygiene of Housing, Am. Public Health Assn. (50 West Fiftieth St., New York, N. Y.) 28, 351 (March 1938).

<sup>3</sup> These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

